

# THE MERCK INDEX

AN ENCYCLOPEDIA OF  
CHEMICALS, DRUGS, AND BIOLOGICALS

THIRTEENTH EDITION

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ral acids. Aq -70°; reduced  
mpn.

5-1] Cobaltous.  $\text{Co}_3\text{O}_4$ ; mol  
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ent, 202, 491-  
3-13; 16, 3-15

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der, Petzold, loc.  
(1969).

crystal structure.  
a vacuum. Prac-  
 $\text{Cl}_2$ ; sol in  $\text{HNO}_3$ .

obalt from nickel.

782-01-9] Hexa-  
potassium hexani-  
potassium nitroco-  
C.I. Pigment Yel-  
2.26. Co 13.03%  
 $\text{IO}_2$ 6. Incorrectly  
of  $\text{KNO}_2$  to a so-  
m. 32, 548 (1962).  
c. crystals. Very  
ly insol in alcohol:

n painting on glass  
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$\text{C}_4\text{H}_6\text{CoO}_4$ ; mol wt  
36.15%. Co( $\text{C}_2\text{H}_3$ -  
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al in Kirk-Othmer  
(Interscience, New  
dered Co and acetic  
prepn by oxidation  
cid: Gwynn et al.

US 3246024 (1966 to Gulf). Review: de Bie, Doyen, Cobalt  
15, 3-13; 16, 3-15 (1962).

Light-pink crystals. Readily sol in water.

**Tetrahydrate.** Bis(acetato)tetraaquacobalt. Intense red, monoclinic, prismatic crystals. d 1.705. On heating becomes anhydrous by 140°. Sol in water, alcohols, dil acids, pentyl acetate. pH of 0.2 molar aq soln 6.8.

USE: Bleaching agent and drier for lacquers, varnishes; in anodizing; catalyst for oxidation and esterification; foam stabilizer for malt beverages.

**2459. Cobaltous Arsenate.** [7785-24-2] C.I. 77350.  $\text{As}_2\text{Co}_3\text{O}_8$ ; mol wt 454.64. As 32.96%, Co 38.89%, O 28.15%.  $\text{Co}_3(\text{AsO}_4)_2$ . Octahydrate occurs in nature as *erythrite* or *cobalt bloom*. Prepn: Gmelin's, Cobalt (8th ed.) 58, (part A), 305 (1932) and supplement, 752 (1961); Charles-Messance et al., Bull. Soc. Chim. France 1962, 574. See Colour Index vol. 4 (3rd ed., 1971) p 4664.

Octahydrate, pink to blood-red, monoclinic, fine needles. On heating becomes anhydr by 400°. Dec by 1000° to  $\text{Co}_6\text{As}_2\text{O}_{11}$ . d 2.9-3.1. Practically insol in water. Sol in dil mineral acids, in  $\text{NH}_4\text{OH}$ .

USE: Painting on glass and porcelain.

**2460. Cobaltous Bromide.** [7789-43-7] Cobalt dibromide.  $\text{Br}_2\text{Co}$ ; mol wt 218.74. Br 73.06%, Co 26.94%.  $\text{CoBr}_2$ . Prepn of hexahydrate from  $\text{CoCO}_3$  and HBr: Clark, Buchner, J. Am. Chem. Soc. 44, 230 (1922). Prepn of anhydr: *eidem, loc. cit.*; Watt et al., ibid. 77, 2752 (1955); Wydeven, Gregory, J. Phys. Chem. 68, 3249 (1964).

Bright green solid or lustrous green cryst leaflets. mp 678° (under HBr and  $\text{N}_2$ );  $d_4^{25}$  4.909. Hygroscopic, forms hexahydr in air. Readily sol in water, methanol, ethanol, acetone, methyl acetate.

**Hexahydrate.** Red to reddish-purple, deliques, prismatic crystals. mp 47-48°.  $d_4^{25}$  2.46. Loses 4 $\text{H}_2\text{O}$  at 100° giving the purple dihydrate, and all  $\text{H}_2\text{O}$  by 130°. Sol in water giving red or blue soln depending on concn and temp, in methanol giving red soln, in ethanol, acetone, ether, methyl acetate giving blue solns. *Keep well closed.*

USE: Chiefly in hygrometers; also in catalysts for organic reactions.

**2461. Cobaltous Carbonate.** [513-79-1]  $\text{CCoO}_3$ ; mol wt 118.94. C 10.10%, Co 49.55%, O 40.35%.  $\text{CoCO}_3$ . Occurs in nature as the mineral *cobalt spar* or *sphaerocobaltite*. Prepn by heating a soln of a cobaltous salt with  $\text{Na}_2\text{CO}_3$ : Schlessinger, Inorg. Syn. 6, 189 (1963) where it is the starting material for the prepn of trinitrotriamminecobalt. Review: de Bie, Doyen, Cobalt 15, 3-13; 16, 3-15 (1962).

Red powder or rhombohedral crystals. d 4.13. Almost insol in water, alcohol, methyl acetate. Does not react with cold concd  $\text{HNO}_3$  or HCl; when heated, dissolves with evolution of  $\text{CO}_2$ . Oxidized by air or weak oxidizing agents to cobaltic carbonate.

**Hexahydrate.** Pink to violet-red cryst needles. Ptd when excess  $\text{CO}_2$  is present during prepn. On heating becomes anhydr by 140°. Stable in air.

**Cobaltous carbonate basic.** Cobalt carbonate hydroxide.  $\text{C}_2\text{H}_6\text{Co}_5\text{O}_{12}$ ; mol wt 516.73.  $\text{Co}_5(\text{OH})_6(\text{CO}_3)_2$ . Pale-red powder, usually containing some water. Practically insol in water; sol in dilute acids and ammonia.

USE: In ceramics; manuf of Co pigments; prepn of Co compds.

**THERAP CAT (VET):** Nutritional factor. Used in cobalt deficiency in ruminants.

**2462. Cobaltous Chloride.** [7646-79-9] Cobalt dichloride.  $\text{Cl}_2\text{Co}$ ; mol wt 129.84. Cl 54.61%, Co 45.39%.  $\text{CoCl}_2$ . Prepn of anhydr from Co powder and  $\text{Cl}_2$ : Osthoff, West, J. Am. Chem. Soc. 76, 4732 (1954); from the acetate and acetyl chloride: Watt et al., ibid. 77, 2752 (1955); by dehydration of the hexahydrate with  $\text{SOCl}_2$ : Hecht, Z. Anorg. Chem. 254, 51 (1947); prepn of the hexahydrate by treating an aqueous soln of a cobaltous salt with HCl: Cobalt—Its Chemistry, Metallurgy, and Uses, R. S. Young, Ed., A.C.S. Monograph Series no. 149 (Reinhold, New York, 1960) p 76. Review: de Bie, Doyen,

Cobalt 15, 3-13; 16, 3-15 (1962). Toxicity studies: G. J. A. Speijers et al., Food Chem. Toxicol. 20, 311 (1982); P. P. Singh, A. Y. Junnarkar, Indian J. Pharmacol. 23, 153 (1991). Review of toxicology: B. Venugopal, T. D. Luckey, Environ. Qual. Safety Suppl. 1, 4-73 (1975).

Pale-blue hygroscopic leaflets; colorless in very thin layers; turns pink on exposure to moist air. mp 735°; bp 1049°;  $d_4^{25}$  3.367. Dec 400° on long heating in air. Sublimes at 500° in HCl gas, forming iridescent, fluffy, colorless cryst. Sol in water, alcohols, acetone, ether, glycerol, pyridine.  $\text{LD}_{50}$  in mice, rats (mg/kg): 360.0, 171.0 orally; 92.6, 36.9 i.p.; 23.3, 4.3 i.v. (Singh, Junnarkar).

**Hexahydrate.** [7791-13-1] Monoclinic crystals. Structure is reported to be  $[\text{CoCl}_2(\text{H}_2\text{O})_4]_2\text{H}_2\text{O}$ : Mizuno et al., J. Phys. Soc. Japan 14, 383 (1959). C.A. 53, 14630i (1959). Pink to red, slightly deliques, monoclinic, prismatic crystals. mp 87°;  $d^{20}$  1.924. On heating loses 4 $\text{H}_2\text{O}$  at 52-56° forming the dihydrate, violet or blue crystals,  $d_4^{25}$  2.477, stable unless exposed directly to moisture. Loses another  $\text{H}_2\text{O}$  by 100°, giving monohydrate, violet, hygroscopic, amorphous solid or needles. Remaining  $\text{H}_2\text{O}$  lost at 120-140°. Sol in water, alcohols, acetone, ether, glycerol. pH of 0.2 molar aq soln 4.6. The aq soln is pink to red, but turns blue when heated or when HCl or  $\text{H}_2\text{SO}_4$  is added. *Keep well closed.*  $\text{LD}_{50}$  orally in rats: 766 mg/kg (Speijers).

**Caution:** Large amounts of  $\text{CoCl}_2$  depress erythrocyte production. May lead to death in children. Other effects include cutaneous flushing, chest pains, dermatides, tinnitus, nausea and vomiting, nerve deafness, thyroid hyperplasia, myxedema, congestive heart failure. See E. Beutler et al., Clinical Disorders of Iron Metabolism (Grune & Stratton, New York, 1963) pp 175-178.

USE: Invisible ink; humidity and water indicator; in hygrometers; temp indicator in grinding; in electroplating; for painting on glass and porcelain; prepn of catalysts; fertilizer and feed additive; foam stabilizer in beer; as absorbent for military poison gas and ammonia; in manuf of vitamin  $\text{B}_{12}$ . Radioactive cobalt chloride,  $^{57}\text{CoCl}_2$  (half-life 271.79 days, pure gamma emitter) used in Mössbauer effect (nuclear clock)..

**THERAP CAT:** Hematinic.

**THERAP CAT (VET):** Nutritional factor. Used in cobalt deficiency in ruminants.

**2463. Cobaltous Chromate(III).** [13455-25-9] Cobalt chromite.  $\text{CoCr}_2\text{O}_4$ ; mol wt 226.92. Co 25.97%, Cr 45.83%, O 28.20%. Prepn: Gmelin's, Cobalt (8th ed.) 58, (part A), 479 (1932) and supplement, 874-876 (1961).

Brilliant greenish-blue powder having a cubic spinel structure. Almost insol in concd HCl and  $\text{HNO}_3$ .

USE: Green pigment for ceramics.

**2464. Cobaltous Cyanide.** [542-84-7] Cobalt cyanide.  $\text{C}_2\text{CoN}_2$ ; mol wt 110.97. C 21.65%, Co 53.11%, N 25.24%. Prepn: Ray, Sahu, J. Indian Chem. Soc. 23, 161 (1946); Gmelin's, Cobalt (8th ed.) 58, (part A), 364 (1932) and supplement, 712 (1961). Structure reported as  $\text{Co}_3[\text{Co}(\text{CN})_6]_2$ : P. S. Poskozim et al., J. Inorg. Nucl. Chem. 35, 687 (1973). Prepn and structure as  $\text{Co}(\text{CN})_2$ : D. M. S. Mosha, D. Nicholls, Inorg. Chim. Acta 38, 127 (1980).

Deep-blue, very hygroscopic powder.  $d_4^{25}$  1.872.

**Di- to trihydrate.** Pink to reddish-brown powder or needles. Practically insol in water, acids, methyl acetate; sol in alkali cyanide solns.

USE: In cobalt catalysts.

**2465. Cobaltous Fluoride.** [10026-17-2] Cobalt difluoride.  $\text{CoF}_2$ ; mol wt 96.93. Co 60.80%, F 39.20%. Prepn by the action of HF on anhydr  $\text{CoCl}_2$ : Kwasnik in *Handbook of Preparative Inorganic Chemistry*, vol. 1, G. Brauer, Ed. (Academic Press, New York, 2nd ed., 1963) p 267; on  $\text{CoCO}_3$ : Clark, Buchner, J. Am. Chem. Soc. 44, 230 (1922); on Co: Muettterties, Castle, J. Inorg. Nucl. Chem. 18, 148 (1961).

Rosy-red tetragonal crystals. mp 1100-1200°, forming a red liq. Volatilizes at about 1400°. d 4.43. Sparingly sol in water; readily sol in warm mineral acids. Forms di-, tri-, and tetrhydrates, all sol in water; their aq solns are dec by boiling, forming the oxyfluoride  $\text{CoF}_2 \cdot \text{CoO} \cdot \text{H}_2\text{O}$ .

USE: Catalyst for organic reactions.

**Note:** This substance is reasonably anticipated to be a human carcinogen: *Ninth Report on Carcinogens* (PB2000-107509, 2000) p III-155.

**USE:** Catalyst; mordant for textiles.

**6525. Nickel Acetylacetone.** [3264-82-2] Bis(2,4-pentanedionato-*O,O'*)nickel; bisacetylacetonatnickel(II); bis(2,4-pentanediono)nickel(II); 2,4-pentanedione nickel complex.  $C_{10}H_{14}NiO_4$ ; mol wt 256.91. C 46.75%, H 5.49%, Ni 22.85%, O 24.91%.  $Ni(CH_3COCHCOCH_3)_2$ . Also  $Ni(acac)_2$  or  $Ni(AA)_2$ . Prepn from acetylacetone and  $Ni(OH)_2$ : Gash, *Monatsh.* 21, 103 (1900); from acetylacetone and  $NiCl_2 \cdot 6H_2O$ : Charles, Pawlikowski, *J. Phys. Chem.* 62, 440 (1958); from 4-diethylaminom-3-pentene-2-one and  $NiCl_2 \cdot 6H_2O$ : Gash, *Can. J. Chem.* 45, 2109 (1967). *See also* Fernelius, Bryant, *Inorg. Syn.* 5, 105 (1957). Exists as a trimer in the solid state: Bullen, *Nature* 177, 537 (1956); Bullen *et al.*, *Inorg. Chem.* 4, 456 (1965); as a monomer in the vapor phase: Fackler *et al.*, *J. Phys. Chem.* 72, 4631 (1972). Structure of dihydrate: Montgomery, Lingafelter, *Acta Cryst.* 17, 1481 (1964).

Emerald-green orthorhombic crystals. mp 229-230°. bp<sub>11</sub> 220-235°.  $d^{17} 1.455$ . uv max ( $10^{-4}M$  in  $CHCl_3$ ): 298, 265 nm ( $\log \epsilon$  4.34, 4.44). Sol in water, alcohol, chloroform, benzene. Insol in ether, ligroin.

**USE:** Catalyst.

**6526. Nickel Bromide.** [13462-88-9] Nickel dibromide.  $Br_2Ni$ ; mol wt 218.50. Br 73.14%, Ni 26.86%.  $NiBr_2$ .

**Trihydrate.** Yellowish-green, very deliquescent crystals; loses its water at about 200°, the anhydrous salt is a golden-yellow color and sublimable in absence of air. Sol in one part water, in alcohol. *Keep well closed.*

**6527. Nickel Carbonate Hydroxide.** [12607-70-4]  $CH_4Ni_3O_7$ ; mol wt 304.12. C 3.95%, H 1.33%, Ni 57.90%, O 36.83%.  $NiCO_3 \cdot 2Ni(OH)_2$ . Tetrahydrate occurs in nature as the mineral *zaratite*.

**Tetrahydrate.** Green, odorless powder. Insol in water. Sol in ammonia and in dil acids with effervescence.

**USE:** Nickel-plating; catalyst for hardening of fats; in ceramic colors and glazes.

**6528. Nickel Carbonyl.** [13463-39-3] Nickel tetracarbonyl.  $C_4NiO_4$ ; mol wt 170.73. C 28.14%, Ni 34.38%, O 37.48%.  $Ni(CO)_4$ . Intermediate in nickel refining. Made by passing carbon monoxide over finely divided nickel: Mond *et al.*, *J. Chem. Soc.* 57, 749 (1890); Gilliland, Blanchard, *Inorg. Syn.* 2, 234 (1946). Use of nickel carbonyl in organic synthesis: G. Wilke *et al.*, *Angew. Chem. Int. Ed.* 5, 151 (1966); M. F. Semmelhack in *Organic Reactions* vol. 19 (Wiley, New York, 1972) p 115; E. J. Corey, H. A. Kirst, *J. Am. Chem. Soc.* 94, 667 (1972). Kinetic studies: D. H. Stedman *et al.*, *Science* 208, 1029 (1980). Toxicity study: Hackett, Sunderman, *Arch. Environ. Health* 14, 604 (1967). Review: Nicholls in *Comprehensive Inorganic Chemistry* vol. 3, J. C. Bailar, Jr. *et al.*, Eds. (Pergamon Press, Oxford, 1973) pp 1115-1119.

Colorless, volatile liquid. *Poisonous!* Oxidizes in the air; explodes at about 60°.  $d^{17} 1.318$ . bp 43°. mp -19.3°. Crit temp about 200°. Crit pressure about 30 atm. Sol in about 5000 parts water free from air; sol in alcohol, benzene, chloroform, acetone, carbon tetrachloride.  $LD_{50}$  in rats (mg/kg): 39 i.p.; 63 s.c.; 66 i.v. (Hackett, Sunderman).

**Caution:** Potential symptoms of overexposure are headache, vertigo; nausea, vomiting, epigastric pain; substernal pain; cough, hyperpnea; cyanosis; weakness; leukocytosis; pneumonitis; delirium; convulsions. *See NIOSH Pocket Guide to Chemical Hazards* (DHHS/NIOSH 97-140, 1997) p 222. *See also* *Clinical Toxicology of Commercial Products*, R. E. Gosselin *et al.*, Eds. (Williams & Wilkins, Baltimore, 5th ed., 1984) Section II, p. 145. This substance is reasonably anticipated to be a human carcinogen: *Ninth Report on Carcinogens* (PB2000-107509, 2000) p III-155.

**USE:** In organic synthesis; production of high-purity nickel powder and continuous nickel coatings on steel and other metals.

**6529. Nickel Chloride.** [7718-54-9] Nickel dichloride.  $Cl_2Ni$ ; mol wt 129.60. Cl 54.71%, Ni 45.29%.  $NiCl_2$ . Evalu-

ation of carcinogenic risk: *IARC Monographs* 49, 257-445 (1990).

Yellow deliquescent scales. Sol in water (g/l): 642 (20°), 876 (100°). Sol in ethanol, ammonium hydroxide. Insol in nitric acid. Sublimable in absence of air and readily absorbs  $NH_3$ . The aq soln is acid; pH about 4. *Keep well closed.*  $LD_{50}$  in mice, rats (mg/kg): 48, 11 i.p. (IARC).

**Hexahydrate.** [7791-20-0] Green, deliquescent crystals or crystalline powder. Monoclinic. Structure reported to be *trans*- $[NiCl_2(H_2O)_4] \cdot 2H_2O$ : Mizuno, *J. Phys. Soc. Japan* 16, 1574 (1960), *C.A.* 55, 26605g (1961). Sol in about one part water, in alcohol.

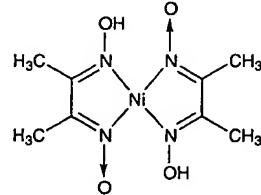
**USE:** Anhydrous salt as absorbent for  $NH_3$  in gas masks. Hexahydrate for nickel electroplating; manuf nickel catalysts.

**6530. Nickel Cyanide.** [557-19-7]  $C_2N_2Ni$ ; mol wt 110.73. C 21.69%, N 25.30%, Ni 53.01%.  $Ni(CN)_2$ . Prepn of yellow-brown anhydrous salt: Aynsley, Campbell, *J. Chem. Soc.* 1958, 1723. (The commercial salt usually contains 20-25% water.)

**Tetrahydrate.** Apple-green powder. *Poison!* Insol in water. Slightly sol in dil acids, freely in alkali cyanides, in ammonia, and in ammonium carbonate.

**USE:** In nickel-plating.

**6531. Nickel Dimethylglyoxime.** [13478-93-8] Bis[(2,3-butanedionato)dioximato](-)-*N,N'*nickel; bis(dimethylglyoximato)nickel.  $C_8H_{14}N_4NiO_4$ ; mol wt 288.91. C 33.26%, H 4.88%, N 19.39%, Ni 20.32%, O 22.15%. Prepn: Banks *et al.*, *J. Am. Chem. Soc.* 77, 324 (1955); F. J. Welcher, *Organic Analytical Reagents* vol. 3 (Van Nostrand, New York, 1947) pp 165-179; Thabet *et al.*, *Inorg. Nucl. Chem. Letters* 8, 211 (1972). Structure: Godycki, Rundle, *Acta Cryst.* 6, 487 (1953); Merritt, *Anal. Chem.* 25, 718 (1953).



Scarlet-red, crystalline powder. Sublimes at 250°. Insol in water, acetic acid, ammonia. Sol in dil mineral acids and appreciably sol in abs alcohol.

**USE:** As sun-fast pigment in paints, lacquers, cellulose compounds and cosmetics.

**6532. Nickel Fluoride.** [10028-18-9] Nickel difluoride; nickelous fluoride.  $Fe_2Ni$ ; mol wt 96.69. F 39.30%, Ni 60.70%.  $NiF_2$ . Prepn: Henkel, Klemm, *Z. Anorg. Allgem. Chem.* 222, 74 (1935); Priest, *Inorg. Syn.* 3, 173 (1950); Rochow, Kukin, *J. Am. Chem. Soc.* 74, 1615 (1952); Haendler *et al.*, *ibid.* 3167. Book: *Medical and Biological Effects of Environmental Pollutants: Nickel* (National Acad. Sci., Washington DC, 1975) 277 pp.

Yellowish to green tetragonal crystals (rutile type).  $d^{4.72}$ . Sublimes in HF stream above 1000°. Slightly sol in water (4 g/100 ml at 25°). Aq solns are dec by boiling. Insol in alcohol, ether.  $LD_{50}$  i.v. in mice: 130 mg/kg (Nat. Acad. Sci.).

**Caution:** Chronic exposure may cause mottling of teeth, changes in bones.

**6533. Nickel Formate.** [3349-06-2]  $C_2H_2NiO_4$ ; mol wt 148.73. C 16.15%, H 1.36%, Ni 39.46%, O 43.03%.  $Ni(HCOO)_2$ . Prepn by reaction of formic acid with Ni: Johnson, US 2576072 (1951 to Harshaw Chemical); with  $NiCO_3$ ; Bircumshaw, Edwards, *J. Chem. Soc.* 1950, 1800.

**Dihydrate.** Fine, green, monoclinic crystals. Becomes anhydrous on careful heating to 130-140°; decomposes at 180-200° yielding Ni, CO,  $CO_2$ ,  $H_2$ ,  $H_2O$ ,  $CH_4$ .  $d^{20.2} 2.154$ . Moderately sol in water. Practically insol in alc, formic acid.

**USE:** Manuf of Ni; prepn of Ni catalysts for organic reactions, particularly hydrogenation catalysts.

6534. Ni oxide".  $H_2N$  34.51%.  $Ni(CO)_4$  Monohydrate to form  $NiO$ ; monia.

**Note:** This carcinogen: *i* 2000) p III-15

6535. Ni mol wt 312.50. Iron-black or bluish-green in alcohol. *Keep*

6536. Ni nickel protoxide. Occurs as the Green powder. **Note:** This carcinogen: *i* 2000) p III-15 USE: Paint

6537. Ni 182.70. N 15. Hexahydrate bp 137°. Sol in pH about 4. H. F. Smyth e USE: Nickel

6538. Ni 146.71. C 16. Dihydrate, 1 acids, in solns

6539. Ni 366.02. Ni 48 Octahydrate ammonia.

USE: On ig oil and water

6540. Ni black nickel or 29.02%. Cont Gray-black in sol in water; with evolution of oxygen.

6541. Ni 154.75. Ni 37 icity data: E. J Evaluation of 445 (1990); Tc 454, NIH 96-3 Hexahydrat blue to blue-g 53.3°.  $\beta$ -Form comes blue an somewhat effl yellow anhydr ingly sol in alc ~4.5. LD<sub>50</sub> in gan).

**Heptahydrat** ethanol.

USE: In nic fabrics; blacke

6542. Ni tro[1,1'-biphen phenol; 5,5'-di chlopholan; Ba O<sub>6</sub>; mol wt 345. O 27.82%. A



15 49, 257-445

g/l): 642 (20°),  
e. Insol in nitric  
/ absorbs NH<sub>3</sub>.  
d. LD<sub>50</sub> in mice,esc crystals or  
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e part water, ins masks. Hexa-  
catalysts.N<sub>2</sub>Ni; mol wt  
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ins 20-25% wa-/ Insol in water.  
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30.. Becomes an-  
ses at 180-200°  
54. Moderately  
d.  
r organic reac-6534. Nickel Hydroxide. [12054-48-7] "Green nickel oxide". H<sub>2</sub>NiO<sub>2</sub>; mol wt 92.71. H 2.17%, Ni 63.31%, O 34.51%. Ni(OH)<sub>2</sub>.Monohydrate. Apple-green powder. Decomp above 200° to form NiO and H<sub>2</sub>O. Insol in water. Sol in dil acids, in ammonia.Note: This substance is reasonably anticipated to be a human carcinogen: *Ninth Report on Carcinogens* (PB2000-107509, 2000) p III-155.6535. Nickel Iodide. [13462-90-3] Nickel diiodide. I<sub>2</sub>Ni; mol wt 312.50. I 81.22%, Ni 18.78%. NiI<sub>2</sub>.Iron-black color. Sublimes in absence of air. Hexahydrate, bluish-green very deliquescent crystals. Very sol in water or alcohol. *Keep well closed.*6536. Nickel Monoxide. [1313-99-1] Nickelous oxide; nickel protoxide. NiO; mol wt 74.69. Ni 78.58%, O 21.42%. Occurs as the mineral *bunsenite*.

Green powder; yellow when hot. Insol in water. Sol in acids.

Note: This substance is reasonably anticipated to be a human carcinogen: *Ninth Report on Carcinogens* (PB2000-107509, 2000) p III-155.

USE: Painting on porcelain.

6537. Nickel Nitrate. [13138-45-9] N<sub>2</sub>NiO<sub>6</sub>; mol wt 182.70. N 15.33%, Ni 32.13%, O 52.54%. Ni(NO<sub>3</sub>)<sub>2</sub>.Hexahydrate. Green, deliquescent crystals. d 2.05. mp 56.7°. bp 137°. Sol in 0.4 part water, in alcohol. The aq soln is acid; pH about 4. *Keep well closed.* LD<sub>50</sub> orally in rats: 1.62 g/kg, H. F. Smyth et al., *Am. Ind. Hyg. Assoc. J.* 30, 470 (1969).

USE: Nickel-plating; manuf brown ceramic colors.

6538. Nickel Oxalate. [547-67-1] C<sub>2</sub>NiO<sub>4</sub>; mol wt 146.71. C 16.37%, Ni 40.01%, O 43.62%. NiC<sub>2</sub>O<sub>4</sub>.

Dihydrate, light green powder. Insol in water; sol in mineral acids, in solns of ammonium chloride, nitrate, or sulfate.

6539. Nickel Phosphate. [10381-36-9] Ni<sub>3</sub>O<sub>8</sub>P<sub>2</sub>; mol wt 366.02. Ni 48.11%, O 34.97%, P 16.92%. Ni<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>.

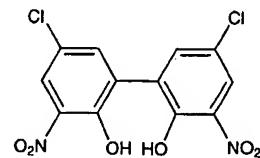
Octahydrate, light green powder. Insol in water; sol in acids, ammonia.

USE: On ignition yields "nickel yellow"—a pigment used in oil and water colors.

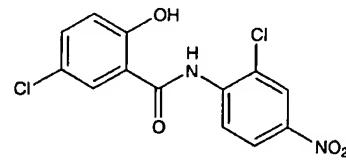
6540. Nickel Sesquioxide. [1314-06-3] Nickelic oxide; black nickel oxide. Ni<sub>2</sub>O<sub>3</sub>; mol wt 165.39. Ni 70.98%, O 29.02%. Contains a variable quantity of water.Gray-black powder. Dec at ~600° into NiO and oxygen. Insol in water; very slightly sol in cold acid; dissolved by hot HCl with evolution of Cl, and by hot H<sub>2</sub>SO<sub>4</sub> or HNO<sub>3</sub> with evolution of oxygen.6541. Nickel Sulfate. [7786-81-4] NiO<sub>4</sub>S; mol wt 154.75. Ni 37.93%, O 41.35%, S 20.72%. NiSO<sub>4</sub>. Acute toxicity data: E. L. Reagan, *J. Am. Coll. Toxicol.* 1, 685 (1992). Evaluation of carcinogenic risk: *IARC Monographs* 49, 257-445 (1990); *Toxicology and Carcinogenesis Studies* (NTP TR-454, NIH 96-3370, 1996) 379 pp.Hexahydrate. [10101-97-0] Two known phases.  $\alpha$ -Form, blue to blue-green tetragonal crystals; transition to  $\beta$ -form at 53.3°.  $\beta$ -Form, green transparent crystals; stable at 40°; becomes blue and opaque at room temp. Sweet astringent taste; somewhat efflorescent. Loses 5H<sub>2</sub>O at ~100°. Greenish-yellow anhydrous salt formed at 280°. Sol in 1.4 parts water; sparingly sol in alcohol, more in methanol. The aq soln is acid; pH ~4.5. LD<sub>50</sub> in male, female rats (mg/kg): 335, 264 orally (Reagan).

Heptahydrate. [10101-98-1] Green crystals. Sol in water, ethanol.

USE: In nickel-plating; as mordant in dyeing and printing fabrics; blackening zinc and brass.

6542. Niclofolan. [10331-57-4] 5,5'-Dichloro-3,3'-dinitro[1,1'-biphenyl]-2,2'-diol; 4,4'-dichloro-6,6'-dinitro- $\alpha$ , $\alpha'$ -biphenol; 5,5'-dichloro-2,2'-dihydroxy-3,3'-dinitrobiphenyl; menichlopholan; Bayer 9015; ME-3625; Bilevon-M. C<sub>12</sub>H<sub>8</sub>Cl<sub>2</sub>N<sub>2</sub>O<sub>6</sub>; mol wt 345.09. C 41.77%, H 1.75%, Cl 20.55%, N 8.12%, O 27.82%. Anthelmintic activity: Meiser, Federmann, US3082151 (1963 to Bayer); P. J. Lane, J. M. Stewart, *Vet. Rec.* 80, 702 (1967). Pharmacokinetics in desert sheep: B. H. Ali et al., *J. Vet. Pharmacol. Ther.* 13, 217 (1990).

THERAP CAT (VET): Anthelmintic (fasciolicide).

6543. Niclosamide. [50-65-7] 5-Chloro-N-(2-chloro-4-nitrophenyl)-2-hydroxybenzamide; 2',5-dichloro-4'-nitrosalicylanilide; 5-chlorosalicyloyl-(o-chloro-p-nitranilide); N-(2'-chloro-4'-nitrophenyl)-5-chlorosalicylamide; Bayer 2353; Cestocide; Niclosamide; Ruby; Trédémine; Yomesan. C<sub>13</sub>H<sub>8</sub>Cl<sub>2</sub>N<sub>2</sub>O<sub>4</sub>; mol wt 327.12. C 47.73%, H 2.47%, Cl 21.68%, N 8.56%, O 19.56%. Prepn: GB 824345 (1959 to Bayer), C.A. 54, 15822b (1960). See also: E. Schraufstätter, R. Gönnert, US 3079297; R. Strufe et al., US 3113067 (both 1963 to Bayer); Bekhli et al., *Med. Prom. SSSR* 1965, 25.

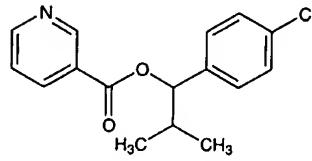
Pale yellow crystals, mp 225-230°. Practically insol in water. Sparingly sol in ethanol, chloroform, ether.

Ethanolamine salt. [1420-04-8] Clonitrilide; Bayluscid. C<sub>13</sub>H<sub>8</sub>Cl<sub>2</sub>N<sub>2</sub>O<sub>4</sub>·C<sub>2</sub>H<sub>7</sub>NO; mol wt 388.21. Yellow-brown solid, mp 204°.

USE: The ethanolamine salt as a molluscicide.

THERAP CAT: Anthelmintic (Cestodes).

THERAP CAT (VET): Anthelmintic (Cestodes).

6544. Nicoclone. [10571-59-2] 3-Pyridinecarboxylic acid 1-(4-chlorophenyl)-2-methylpropyl ester; nicotinic acid  $\alpha$ -chloro- $\alpha$ -isopropylbenzyl ester; 1-(*p*-chlorophenyl)isobutyl nicotinate; *p*-chlorophenylisopropylcarbinol nicotinate; 1-(*p*-chlorophenyl)-1-(nicotinoyloxy)-2-methylpropane; S-486; Lipidium. C<sub>16</sub>H<sub>16</sub>ClNO<sub>2</sub>; mol wt 289.76. C 66.32%, H 5.57%, Cl 12.24%, N 4.83%, O 11.04%. Prepn: J. Nordmann, H. B. Swierkot, FR M3454; eidem, US 3367939 (1965, 1968 both to Kuhlmann).

Base, white needles from methanol and water, mp 61-62° (Maquenne block); 55-56.5° (Culatti block). Very soluble in lipids; sol in alcohols, benzene, toluene, ether and acetone. Practically insol in water.

Hydrochloride. C<sub>16</sub>H<sub>17</sub>Cl<sub>2</sub>NO<sub>2</sub>. Crystals from methanol, mp 124-127°C. LD<sub>50</sub> i.p. in mice: 2.27 g/kg (Nordmann, Swierkot).

THERAP CAT: Antilipemic.

6545. Nicofuranose. [15351-13-0]  $\beta$ -D-Fructofuranose 1,3,4,6-tetra-3-pyridinecarboxylate; fructose 1,3,4,6-tetranicotinate; 1,3,4,6-tetranicotinoylfructofuranose; 1,3,4,6-tetranicotinoyl-D-fructose; Vasperdil; Bradilan. C<sub>30</sub>H<sub>24</sub>N<sub>4</sub>O<sub>10</sub>; mol wt